

KENNEDY SPACE CENTER LAUNCH AND LANDING SUPPORT

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KSC Project Integration
ISS & Spacecraft Processing**

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Agenda

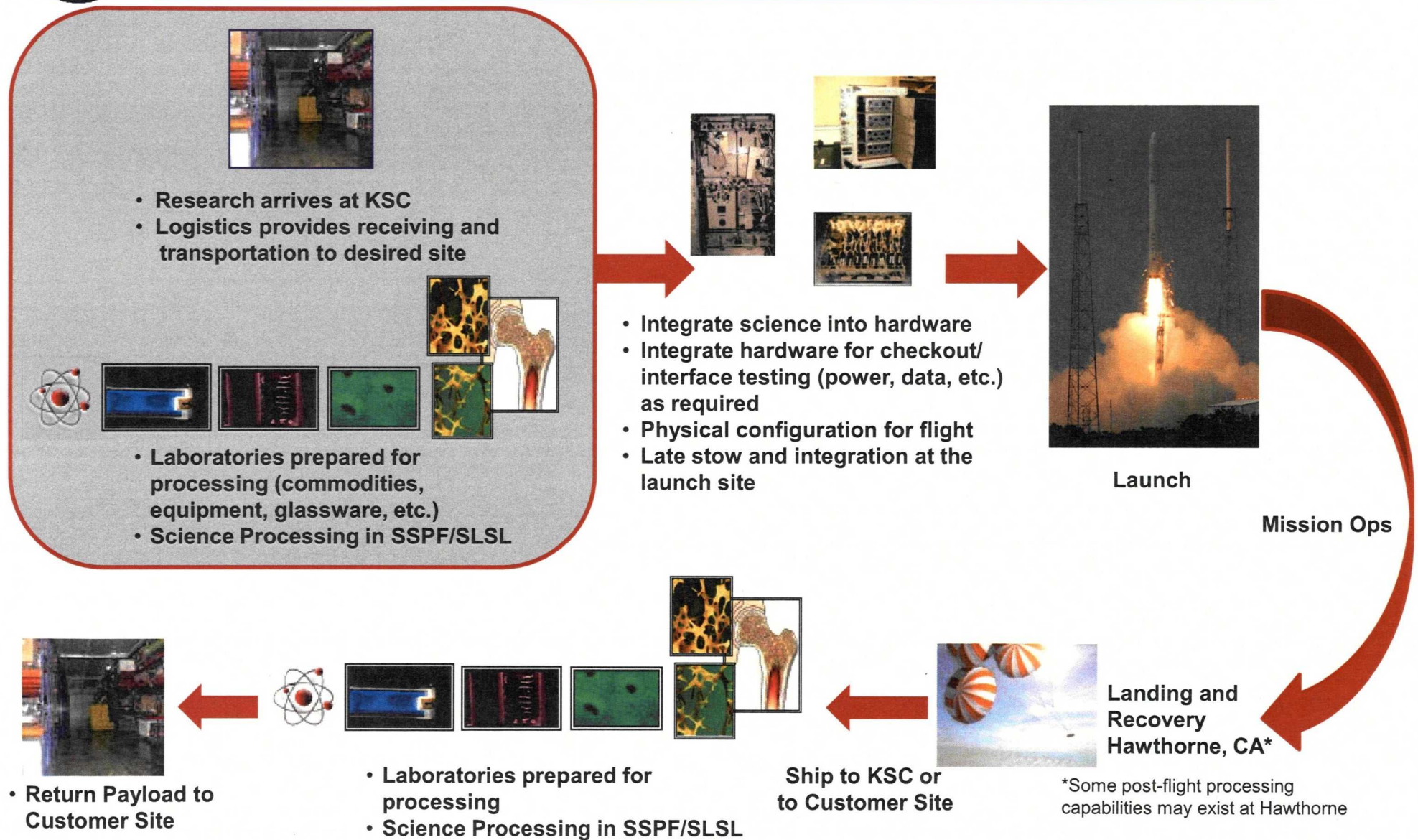
- **KSC Payload Processing**
- **KSC Facilities and Capabilities**
- **Research Development and Life Science Experience**



KSC Payload Processing



Launch Site Processing





Payload Processing

- **Pre-arrival coordination**
 - A Launch Site Support Manager will be assigned to be the customer's advocate throughout processing
 - Identify Ground Support Requirements (detailed operational and administrative products and services needed for processing)
 - Identify Technical Requirements for on-line processing
 - Provide customer procedures for review of safety controls and operations compatibility
 - Identify personnel for badging; complete required training for KSC processing
 - Identify needed Logistics support
 - Transportation/receiving, warehousing, imagery, tool loan
 - Obtain Ground Safety Review Panel approval

- **Customers may utilize KSC labs and resources to complete off-line post-shipment activities prior to turnover for packing or launch**

- **KSC personnel may perform on-line tasks as needed or required**
 - Testing
 - Fluids servicing
 - Integration to carrier



Key Launch Site Processing Roles

- **Time Critical Ground Handling**

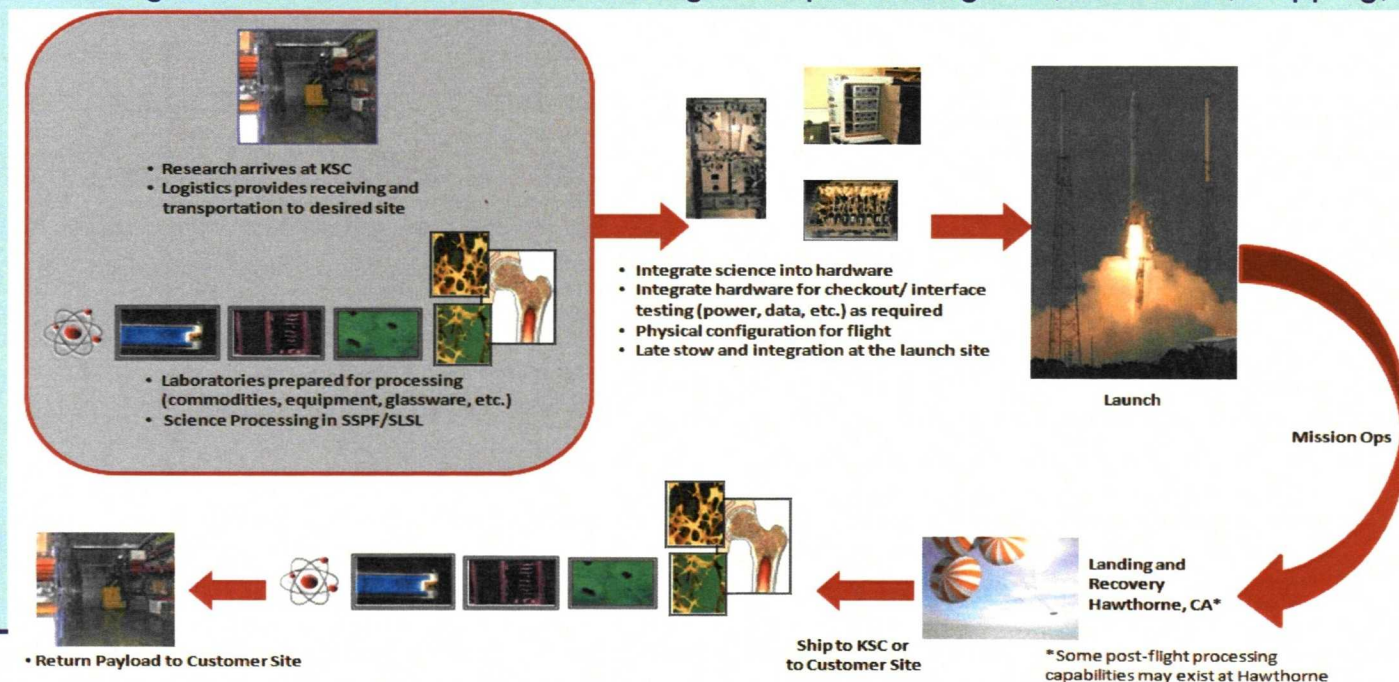
- Final prep & install into launch vehicles, scrub refurbishment to minimize science loss
- Physical retrieval of payload h/w, post mission operations, h/w return to PDs

- **Technical Integration**

- Engineering requirement/criteria development, definition, and implementation for technical requirements datasets
- Verification of payload physical and functional interfaces with applicable interface agreements through certified tests, inspections, and/or analyses

- **Customer Advocacy**

- Advanced planning and documentation of support requirements and unique agreements
- Arrangement of badging, development of schedules, provision of necessary documentation and general customer assistance with ground processing flow, deadlines, shipping, and offline

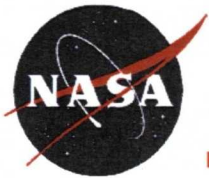




Key Launch Site Processing Roles

- **Customer Advocacy**

- Advanced planning and documentation of support requirements and unique agreements
- Support for real-time off-line processing changes
- Input to research ground processing policy and philosophy
- Operations & Maintenance (O&M) and unique outfitting of science processing laboratories
- Prioritization of on-dock arrivals
- Communication of launch site safety and base requirements
- Review of ground safety packages
- Provision of active operational support to Payload Developers during early design phases
- Arrangement of badging, development of schedules, provision of necessary documentation and general customer assistance with ground processing flow, Ground Safety Review Panel deadlines, shipping, and offline lab outfitting
- Launch site support oversight for customer's payload processing, launch, and landing activities
- Ensure applicable payload requirement documents are met
- Review payload customer procedures ensuring Agency/Center support requirement policies are accurately reflected



Key Launch Site Processing Roles

- **Technical Integration**

- Engineering requirement/criteria development, definition, and implementation for technical requirements datasets, including Time-Critical Ground Handling Requirements
- Payload turnover activities (Integration Data Package review, issue resolution)
- Procedure development and review of customer ground and flight procedures
- Experiment off-line operations (e.g. sharp edge inspections) & on-line processing ops
- O&M of ISS Payload Ground Support Equipment, simulators, rack testers, etc.
- Verification of payload physical and functional interfaces with applicable interface agreements through certified tests, inspections, and/or analyses
- Turnover and installation into launch vehicle
- Scrub refurbishment to minimize science loss
- Landing early destow coordination/execution
- Developing/Coordinating implementation of experiment upload schedules
- Remote launch/landing operational responsibilities (TBD post-Shuttle)

- **Time Critical Ground Handling**

- Final prep & install into launch vehicles, scrub refurbishment
- Interface with flight crew for technical issues
- Coordination of real-time destow tasks and schedules with Flight Crew Systems
- Physical retrieval of payload hardware, post mission operations, hardware return to PDs
- Coordination with researchers



Leveraging KSC Experience

- **Extending existing roles using current expertise**
 - Commercial Vehicle Late Stow/Early Destow
 - Sub-Rack/Pallet Payload Interface Tests
 - Sub-Rack/Pallet Payload Verification
 - Sub-Rack/Pallet On-Orbit Troubleshooting
 - Ops & Science Processing Consultation during Payload Design
 - National Lab & IP Facility-Class Payload Physical Integration and Test
 - National Lab & IP Science Processing Support
 - Assistance with Animal Care processing



KSC Facilities and Capabilities



Space Station Processing Facility

- **High Bay**

- 38,000 ft² Class 100K clean area
- 8 footprints, completely reconfigurable
- Available commodities include 208V/480V power, chilled water, GN₂, GHe, LN₂
- Two 30-ton electrical bridge cranes with 50-ft hook height



- **Intermediate Bay**

- 17,000 ft² Class 100K clean area
- Two 5-ton electrical bridge cranes with 25-ft hook height

- **Airlock**

- 5000 ft² Class 300K clean area
- 15-ton electrical bridge crane with 50-ft hook height

- **Administrative Space**

- Office Space for approximately 1000 employees
- 25 Conference Rooms

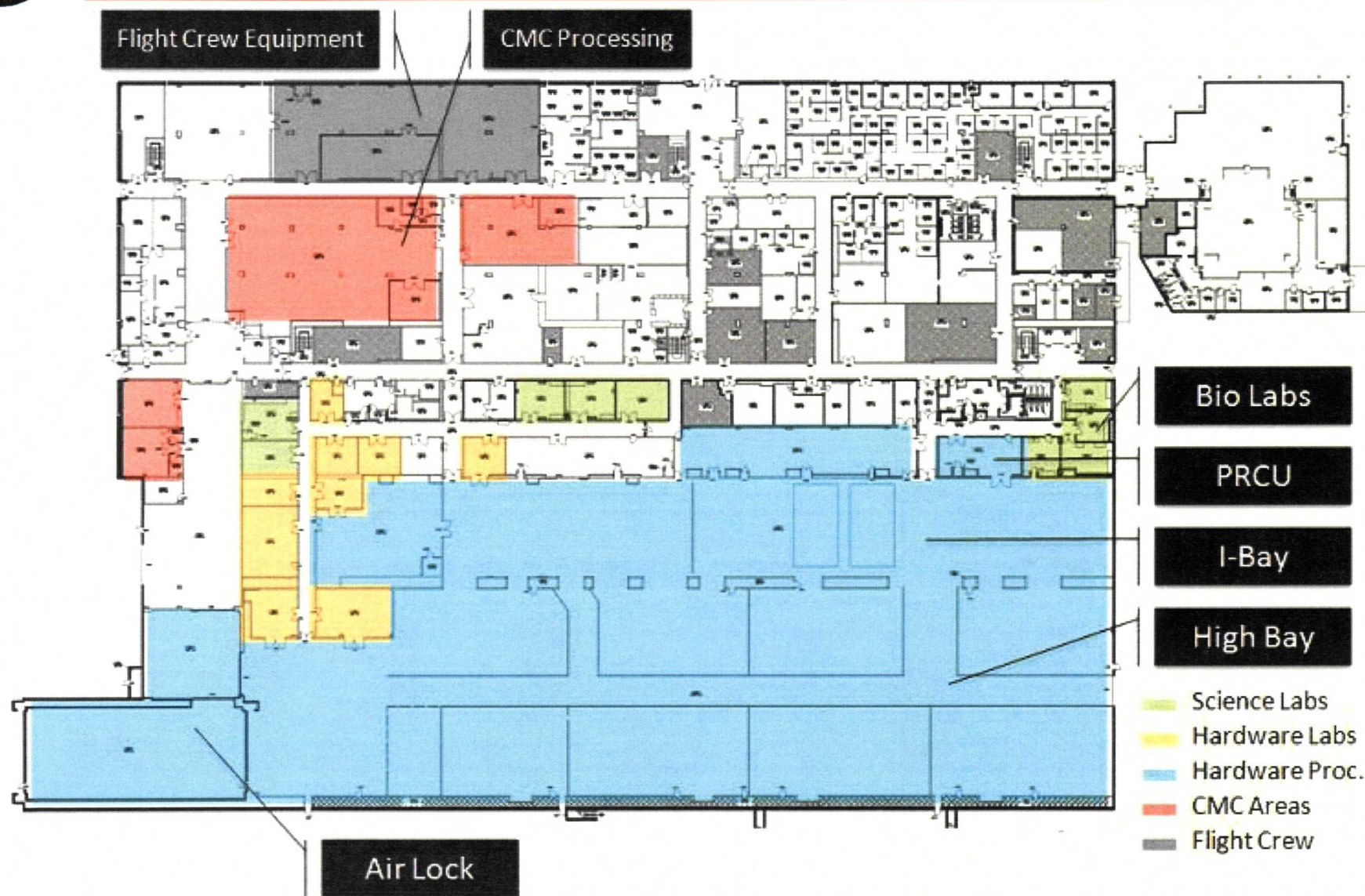
- **Specialty Areas**

- Off-Line Processing Rooms
(7 Science Labs, 2 Central Services Labs, 8 Hardware Labs)
- 9 control rooms located on raised floor areas
- Multi-Layer Insulation (MLI) Sewing Room
- Vapor Containment Facility to house liquid anhydrous ammonia
- Flight Crew Room: final checkpoint for all flight crew equipment





SSPF Floor Plan





SSPF Testing Capabilities

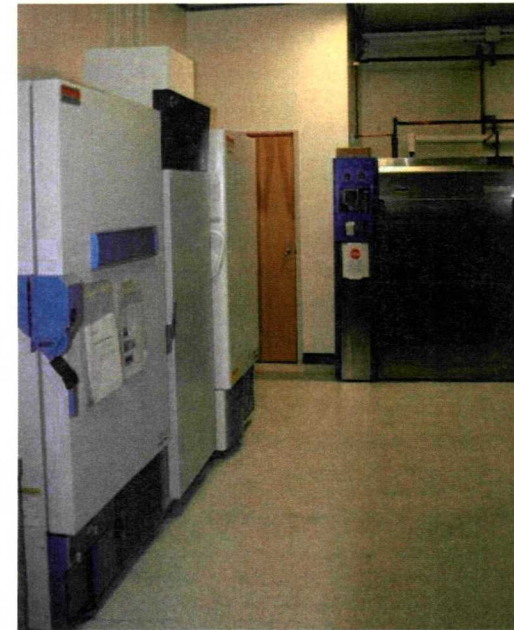
- **Payload Rack Checkout Unit (PRCU)**
 - Provides ISS interface verifications which include Power, Command & Data Handling, Video, Fluids, Vacuum, Fire Detection System, Impedance Analysis and GN₂
 - Includes a connection to MSFC HOSC for commanding and data monitoring
- **Testing Capabilities**
 - International Standard Payload Rack (ISPR)
 - Sub-rack payloads
 - Sub-pallet payloads (unpressurized) which will be mounted on a truss location or Express Logistics Carrier (ELC)
 - Includes final flight configuration testing with an ELC Simulator and verification testing
- **Fluids Servicing**
 - Spacecraft Fueling (Mono and Bipropellant)
 - Gases up to 6000 PSI (GN₂, GH₂, etc)
 - O₂ and NH₃ Servicing
 - Noble Gas servicing at lower pressures
 - Cryo Servicing





SSPF Lab Capabilities

- **Lab Capabilities Summary**
 - Class 300,000 clean rooms
 - 7 Science Labs
 - 8 Hardware Labs
 - 2 Central Services
 - Specialized Science Equipment
(e.g. laminar flow benches, incubators, microscopes, biological safety cabinets, portable fume hoods, water baths, etc.)
- **Payloads Processing Support**
 - Skills, equipment and labs unique to pre/post mission support requirements at launch site for hardware integration, hardware/science integration, offline checkout, including life science & biological payloads





Baseline Data Collection Facility

- **BDCF Mission**

- Optimize the completion of Human Life Sciences Research
- Series of laboratories designed to study astronaut response to spaceflight immediately upon return to Earth

- **Experiment equipment**

- Magnetic Resonance Imaging (MRI)
- Densitometers
- Cardiovascular devices
- Vestibular testing equipment
 - Rotating chairs
 - Treadmills
 - Obstacle courses





Space Life Sciences Laboratory

- **Building Information**

- 73,000 ft² available area
- Population: 140 residents, 38 visitors
- 25 Science Labs
- 8 Hardware Labs
- 6 Animal Holding Rooms

- **Partnerships**

- NASA/KSC: Manages Research & Utilization
- Space Florida: Owner of SLS Lab
- Life Science Services Contract: Tenant of SLS Lab, responsible for O&M
- University of Florida and Florida Tech: Resident university partners

- **Unique Agency Capabilities**

- Provides infrastructure to enable ISS Research including non-exploration research and maturation of critical Exploration technologies
- Skills, equipment and labs unique to pre/post mission support requirements at launch site of life science and biological payloads

- **Specialty Areas**

- Animal Care Facility (ACF) provides animal husbandry & support for space flight missions and meets all necessary Agency & Federal cert/license requirements
- Controlled Environment Lab (CEL)
 - Skills and infrastructure uniquely developed originally for biological sustainable systems (i.e. bio-regenerative life support systems), now serving multi-discipline investigations
 - Orbit Environment Simulators for science 'control' of STS/ISS pressurized environment payloads (temp, humidity, CO₂, lighting)





SLS Lab Capabilities

Controlled Environment Lab

15 Controlled Environment Chambers (CEC)

Low Pressure Test Bed

Lunar/Mars Vacuum Chamber

Animal Care

Rodent/Aquatic/Avian/Insect

Experiment Processing Support

Shuttle/Station/Unmanned

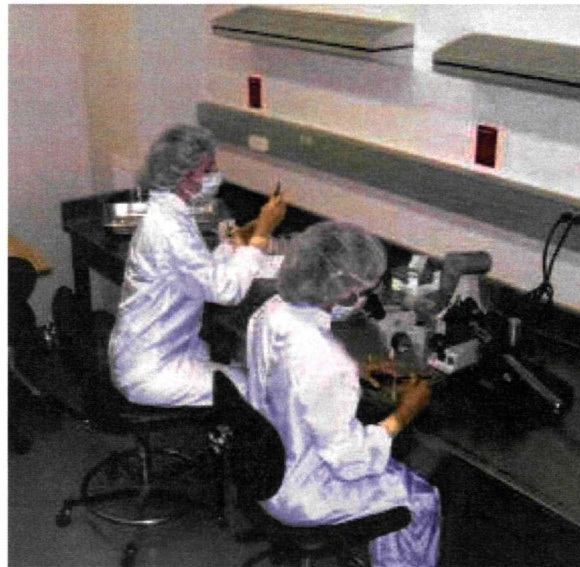
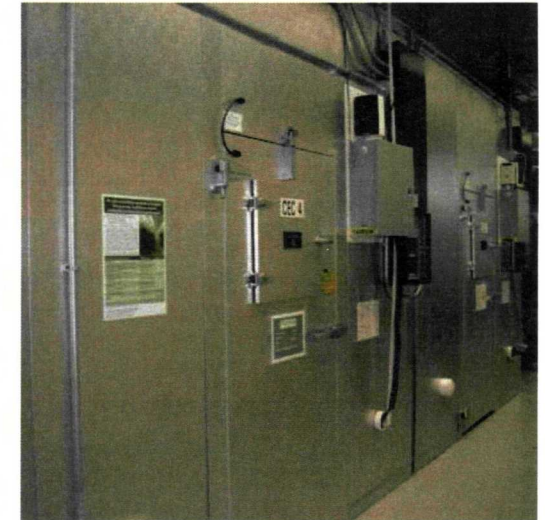
Flight Experiment Development

Design/Testing/Integration

Flight Mission Support

Orbit Environment Simulators (OES)

Experiment Monitoring Area (EMA)





SLS Lab Capabilities

Bimolecular/Microbial Ecology

Genetic Identification, Quantification & Qualification

Analytical Chemistry

Organic/Inorganic/Volatile Gases

Astrobiology

UF & FIT Resident Science Programs

Microscopy/Imaging

Atomic Force (AFM), X-Ray Photoelectron Spectroscopy (XPS), Scanning Electron (SEM), Confocal Fluorescence

Applied Chemistry

In-Situ Resource Utilization (ISRU), Environmental Remediation, Corrosion Detection & Coatings, Polymer & Advanced Materials

Applied Physics

Granular & Surface Systems

Electrostatics

Dust Characterization & Remediation, Surface Physics





Research Development and Life Science Experience



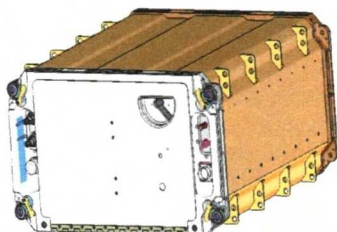
Research Payload Development





KSC ISS-Research Flight Hardware

ABRS



KFT



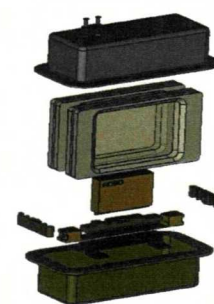
Biotube



BRIC-PDFU & LED



BRIC-Opti



BRIC-60/100



Inventory

•On ISS

1

4

0

0

0

0

•At KSC

1

70

1

10

30

16 (60mm)
15 (100mm)

•Certification

STS & ISS

STS & ISS

STS

STS

STS & ISS

STS &
Progress

•Planned
Upgrades

BFP & YFP
imaging

none

ISS Cert

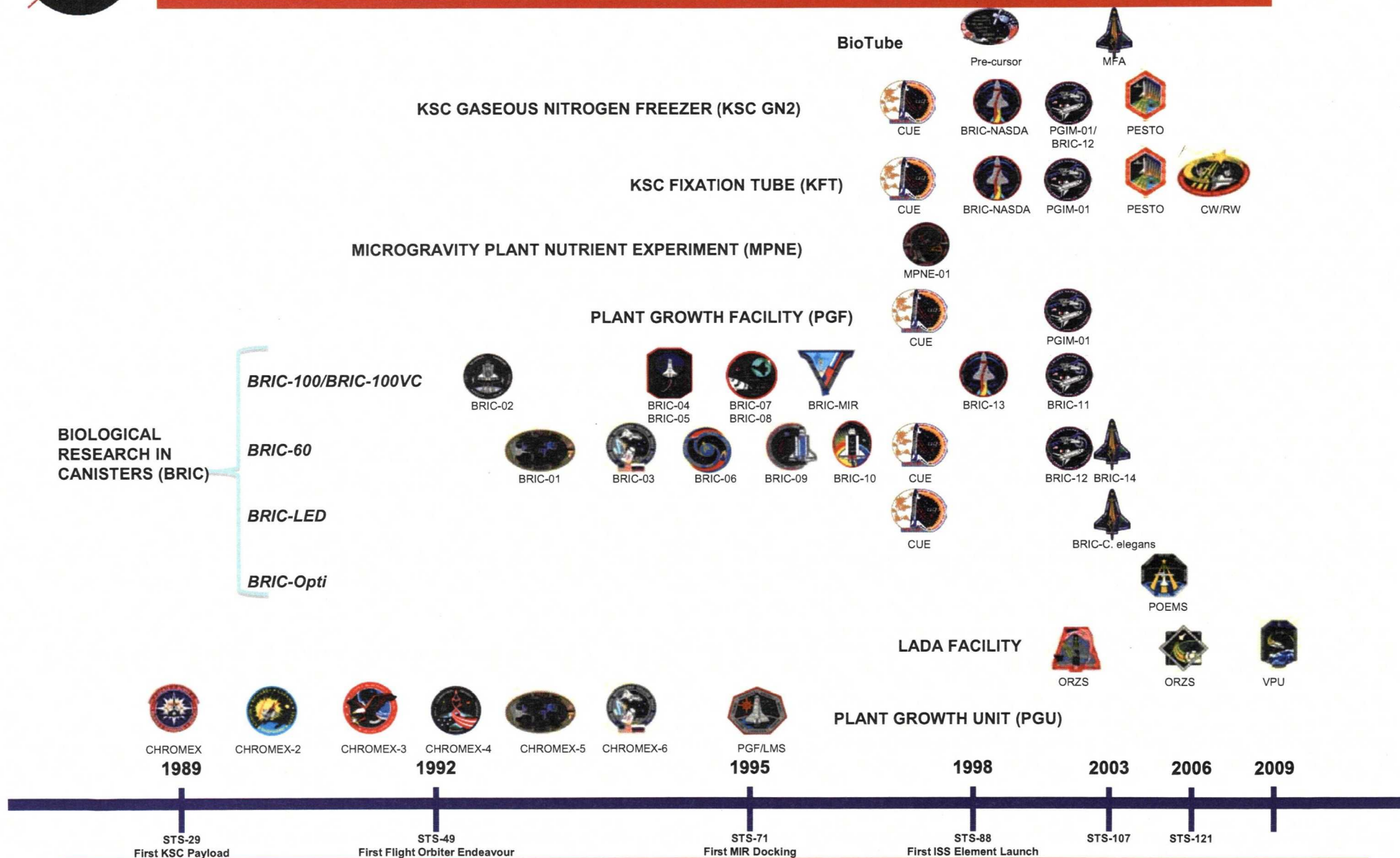
Lid mods
& ISS Cert

none

none



KSC Flight Payload History





KSC Life Science Expertise

- **Areas of Expertise**

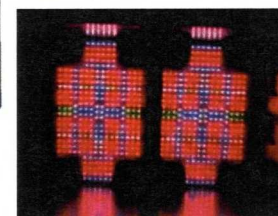
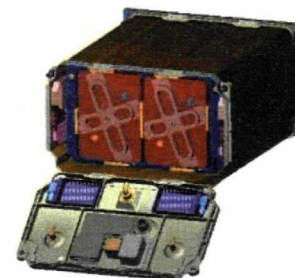
- Processing biological payloads
- Biological payload development and Flight execution
- Developing life support systems & flight hardware
- BRICs and ABRS flight facilities
- Maintaining commitments to Investigators
- Managing Labs to support space related research
- Managing Grants (e.g. ILSRA)

- **Critical Skills**

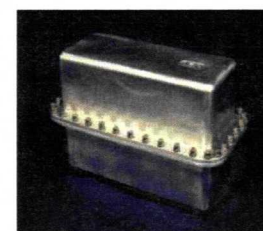
- Mission Integration
- Project Integration
- Payload Scientist
- Science Disciplines: Exploration Life Support, Molecular Biology, Plant Physiology, Analytical Chemistry, Microbial Ecology, Wet Solid Waste, Air Purification
- OES manager, engineer, and technician
- CMDS Software Manager
- Certified Animal Care Manager
- Engineering Disciplines: Optics, Communications, Electrical, Mechanical, Spacecraft Thermal, Fluids, Power Systems, Lighting, Structural

- **Customers**

- NASA HQ / ESMD & SOMD
- International Space Station
- International Science Community
- Florida State Partnership
- ISS National Lab Community
- Commercial



ABRS



BRIC Opti